

Appl. No. : 10/074,534
Filed : February 11, 2002

REMARKS

Claim Amendments

Applicant respectfully requests entry of the instant Amendment to the Claims in which Claim 20 has been rewritten to delete the "amount" terminology that, according to the Office, rendered the previous version of Claim 20 indefinite. Methods for depositing graded SiGe-containing films onto substrates by thermal CVD using a deposition gas comprising trisilane and a germanium precursor are described in the instant specification at, e.g., paragraphs [0056] to [0058], and thus there is no issue of new matter. This change does not narrow the scope of Claim 20.

Applicant reserves the right to file divisional and/or continuation applications containing claims directed to all or part of the subject matter described in the instant application, as well as the subject matter of any claims amended or canceled at any time during the prosecution of this application, and thus unclaimed subject matter is not dedicated to the public.

Priority

Applicant notes that the Office has acknowledged the Applicant's 35 U.S.C. § 119(e) priority claims, but also notes that the published version of this patent application (US 2003/0022528 A1) states on its face: "This is a publication of a continued prosecution application (CPA) filed under 37 C.F.R. 1.53(d)." Applicant believes that this statement on the face of the published version of the patent application is incorrect, as this application is not a CPA. Applicant respectfully requests appropriate correction.

Information Disclosure Statement

Applicant acknowledges receipt of a copy of the PTO 1449 form submitted by Applicant on May 14, 2002, initialed by the Office to indicate consideration of the listed references. The Office states that the foreign patent and documents have been considered to the extent that could be understood from the abstract and drawings. Applicant respectfully points out that English translations of six foreign documents (marked by the Office "English lang[uage] only" on the initialed PTO-1449 form) were supplied to the Office, and thus understand that the Office considered the full text of these English translations.

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Applicant respectfully points out that another IDS was submitted to the Office on November 25, 2002, and that PAIR indicates that the Office received that IDS on December 2, 2002. Since, pursuant to 37 C.F.R. § 1.97, the Office is required to consider the three references submitted with that IDS, Applicant understands that such consideration has already taken place. However, Applicant would appreciate receiving copies of the initialed PTO-1449 form to ensure a complete file.

Claim Rejections - 35 U.S.C. § 112

Claims 20-33 have been rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention. Specifically, the Office states that the phrase "a deposition gas comprising amounts of trisilane and a germanium precursor that are varied during deposition" renders the claim indefinite. Applicant respectfully disagrees. However, to facilitate timely prosecution, Applicant has rewritten Claim 20 to delete the language to which the Office objects. Various methods may be used to deposit graded SiGe films on a substrate by thermal CVD. For example, as explained in the instant specification at, e.g., paragraphs [0052] to [0058], a graded film may be deposited by varying the relative amounts of trisilane and germanium precursor in the deposition gas during deposition, as distinguished from depositing the graded film using a deposition gas in which the relative amounts of trisilane and germanium precursor are held constant. The relative amounts of trisilane and germanium precursor may be varied during deposition by, e.g., changing the germane flow rate, see paragraph [0056], or by changing the relative partial pressures of the chemical precursors, see paragraph [0050].

Applicant respectfully submits that Claim 20 fully meets the requirements of § 112. Therefore, Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 20-33 under 35 U.S.C. § 112, second paragraph.

Claim Rejections - 35 U.S.C. § 103(a)

Claims 1-15 and 20-33 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Rolfson (U.S. Patent No. 5,786,027) in view of U'Ren (U.S. Patent No. 6,365,479). Applicant respectfully traverses this rejection.

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The Office states that "Rolfson discloses a process for depositing a non-single crystalline Si-Ge-containing material on to a surface. . . ." Paper No. 9 at 4, 6. Applicant respectfully disagrees. Rolfson discloses a process for depositing a polysilicon material, not a SiGe-containing material as claimed. The portions of Rolfson cited by the Office (abstract lines 2-3 and col. 4, lines 11-14) do not teach or suggest the deposition of a SiGe-containing material.

The Office states that U'Ren "describes introducing a graded SiGe-containing film onto the substrate by thermal CVD using a deposition gas comprising amounts of trisilane and a germanium precursor that are varied during deposition" Paper No. 9 at 6-7. Applicant respectfully disagrees. U'Ren does not disclose the use of trisilane.

The Office recognizes that Rolfson does not describe introducing a germanium precursor to the chamber and depositing a non-single crystalline SiGe film, but states that U'Ren discloses these steps. Paper No. 9 at 4. Thus, with respect to Claim 1, the Office states that:

[I]t would have been obvious to one of ordinary skill in the art at the time of the invention to include U'Ren's step of introducing a germanium precursor to the chamber and depositing a non-single crystalline SiGe containing film onto the substrate in Rolfson's method to provide a process that achieves the desired pre-determined profile that can be controlled in order to produce a multi layer stack with the desired profile (eg. devices with better gain, speed and frequency response).

Paper No. 9 at 5. Likewise, with respect to Claim 20, the Office states that:

[I]t would have been obvious to one of ordinary skill in the art at the time of the invention to include U'Ren's step of introducing a graded SiGe film onto the substrate by thermal CVD using a deposition gas comprising amounts of trisilane and a germanium precursor that are varied during deposition in Rolfson's method to provide a process that achieves the desired pre-determined profile that can be controlled in order to produce a multi layer stack with the desired profile (eg. devices with better gain, speed and frequency response).

Applicant respectfully disagrees because the art contains no indication that the teachings of U'Ren and Rolfson are compatible in the manner suggested by the Office, to say nothing of suggesting such a combination. For example, U'Ren teaches process pressures that are 100 times higher than those used by Rolfson in order to obtain desirable properties in the resulting device, and thus there is no reasonable expectation of success.

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Rolfson discloses depositing polysilicon in an LPCVD chamber at a temperature between 580°C to 650°C and at a pressure of from about 200 mTorr to 1 Torr. *See* Rolfson at col. 4, lines 6-8. Rolfson teaches that, during LPCVD, the different silicon source gases have different surface adsorption characteristics, *see* col. 4, lines 24-33, and that the structural characteristics of the deposited polysilicon layer are a function of the deposition temperatures, *see* col. 3, lines 32-33. It follows that the disclosed 580°C to 650°C temperature and 200 mTorr to 1 Torr pressure conditions are necessary to achieve the particular grain structure desired by Rolfson, *see* col. 2, lines 27-30.

U'Ren discloses a process for concurrently depositing polycrystalline SiGe and single crystal SiGe at the same temperature and pressure of precursor gas, *see* U'Ren Abstract and col. 2, lines 57-62. The polycrystalline SiGe is said to be deposited in the mass controlled mode and the single crystal SiGe is said to be deposited in the kinetically controlled mode, *see* U'Ren Abstract, figure 3, and col. 2, lines 57-62. The process is termed non-selective because single crystal material is deposited over single crystal surfaces, whereas amorphous or polycrystalline material is deposited over amorphous surfaces, *see* U'Ren at col. 7, lines 46-55. The ratio of polycrystalline deposition rate to single crystal deposition rate is called the "deposition ratio" and depends on the deposition temperature and pressure, *see* U'Ren col. 10, lines 40-44. U'Ren reports that, at temperatures and pressures previously used (725°C at 100 Torr), a deposition ratio of about 1:1 was achieved, *see* U'Ren col. 10, lines 44-49. U'Ren desires a deposition ratio of 1:2 (U'Ren at col. 10, lines 49-53), and thus uses a deposition temperature of 650°C and a deposition pressure of 100 Torr (U'Ren at col. 10, lines 17-19) to achieve this deposition ratio. Deposition under these conditions is required in order to achieve single crystal growth in the kinetically controlled mode at a much lower rate than the concurrent polycrystalline growth in the mass controlled mode, *see* U'Ren at col. 10, lines 20-26. Deposition under these conditions is said to result in devices having desirable properties, *see* U'Ren at col. 10, line 58 to col. 11, line 12.

The Office points to U'Ren at figure 1 and col. 3, lines 50-60 as describing the deposition of a non-single crystalline SiGe-containing film, base contact 121. Paper No. 9 at 4. However, that portion of U'Ren states that base contact 121 is deposited by a RPCVD process, not a LPCVD process as required by Rolfson. U'Ren's RPCVD process is conducted at 650°C and 100 Torr in order to achieve the desired 1:2 deposition ratio, *see* U'Ren at col. 10, lines 20-26

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and 51-53. U'Ren's 650°C deposition temperature is the "lower limit" for depositing polycrystalline material, *see* U'Ren at col. 10, lines 15-20, thus teaching away from lower temperatures within Rolfson's 580°C to 650°C range. In addition, U'Ren's 100 Torr deposition pressure is 100 times higher than 1 Torr, the upper range of Rolfson's 200 mTorr to 1 Torr deposition pressure range (*see* Rolfson at col. 4, line 8).

U'Ren's states that use of this narrow process window achieves the desired gain, speed and frequency response in the resulting device:

The control of properties of the polycrystalline deposition for polycrystalline base contact 121 results in maintaining the advantages of silicon-germanium HBT 150. In other words, the advantageous properties of HBT device 150 including the gain, speed, and frequency response are maintained.

For application to the particular HBT structure 150 herein described, the temperature and pressure conditions were approximately 650°C at 100 Torr.

U'Ren at col. 11, lines 3-13. U'Ren neither teaches nor suggests carrying out deposition at the far lower pressures required by Rolfson, nor that such desirable properties would be achieved at those pressures.

Thus, Applicant respectfully submits that one skilled in the art would not be motivated by U'Ren to modify Rolfson to include a germanium precursor because there is no expectation that the lower pressure process of Rolfson would successfully produce a device having the desired gain, speed and frequency response. In the absence of an expectation of success, there is no *prima facie* case of obviousness. *See* M.P.E.P. § 2143.02. Nor is there any motivation to modify Rolfson's deposition conditions to the 650°C/100 Torr conditions employed by U'Ren, because Rolfson desires only polysilicon deposition and U'Ren's conditions produce concurrent single crystal and polycrystalline deposition. There is no *prima facie* case of obviousness where the proposed modification renders the prior art unsatisfactory for its intended purpose or changes the principle of operation of a reference. *See* M.P.E.P. § 2143.01.

Therefore, because the Office has not established a *prima facie* case of obviousness, Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 1-15 and 20-33 under 35 U.S.C. § 103(a) as being unpatentable over Rolfson in view of U'Ren.

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Unexpected Results

As discussed above, Applicant respectfully submits that the Office has not established a *prima facie* case of obviousness. Assuming, *arguendo*, that a *prima facie* case had been established, Applicant respectfully submits that the instant specification provides evidence of unexpected results that is more than sufficient to rebut any such *prima facie* case. In this respect, the Office is respectfully invited to review instant Figures 5-10 and the text of the specification at paragraphs [0052] to [0058], as well as Examples 88-89 and Figures 12-15.

Conclusion

Applicant respectfully submits that the instant claims satisfy the requirements for patentability in view of all of the prior art cited, searched, and considered by the Office, including the 3 references listed in the PTO-1449 form submitted to the Office on November 25, 2002, and respectfully submits that the instant application is in condition for allowance, early notification of which would be appreciated. Should the Office disagree, Applicant respectfully requests a telephonic interview to discuss any outstanding issues. The Office is respectfully invited to contact Applicant's representative at the telephone number provided below in this regard.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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Dated: 4/29/03

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